

METAL CASTING

Project Fact Sheet



PREDICTING PART DISTORTION IN DIE CASTING

BENEFITS

- Enhanced prediction tools results in higher quality castings, reduced scrap, and reduced melting requirements thereby saving energy.
- Reduced energy consumption and emissions due to faster start-up, less die try-out, fewer die modifications, and fewer operating problems.
- Reduced operating cost due to improved first shot capabilities and fewer number of interruptions.
- Second order energy savings due to better dimensional control resulting in less molten material required per shot and fewer secondary machining operations.

APPLICATIONS

Distortion and stress modeling in die casting is a complex problem that has received little attention. This project will develop tools for die casting part and die designers to overcome that problem. The results from this project can be applied throughout the die casting industry.

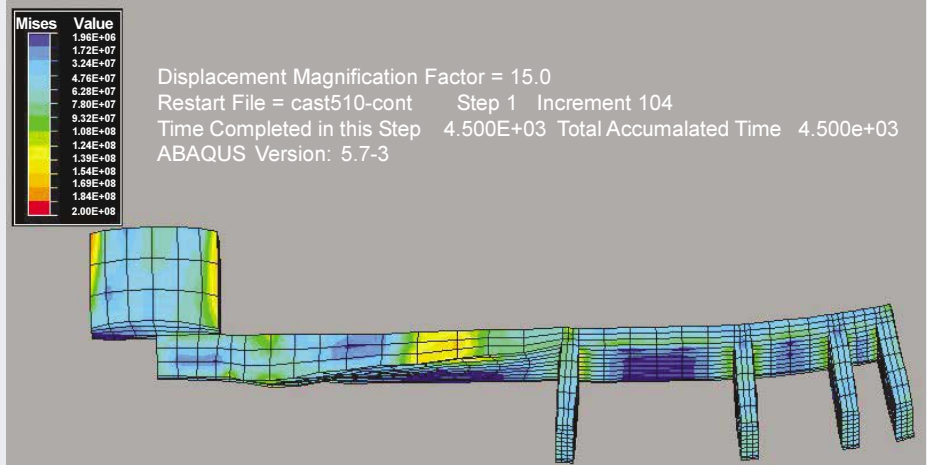
SOFTWARE HELPS IMPROVE DIE DESIGN & PART CAPABILITIES, IMPROVE CONSISTENCY & MEET NOMINAL CASTING DIMENSIONAL

Designers of castings must design for specific dimensions and stress requirements. Dimensional variability that leaves the part out of tolerance results in scrap. A number of factors can result in dimensional variability and better understanding and control over these variables can improve casting quality. This research at Ohio State University will develop modeling techniques to allow die casting part designers to consistently predict the dimensions of a die cast part after cooling and thus reduce the rate of scrapped castings. In addition, being able to closely predict casting dimensions will lead to tighter tolerance and thinner walls.

This project is an extension of current research efforts with OSU and industry partners on the modeling of part distortion in die casting. That research developed geometric and modelling techniques which will allow the part and the die to be related and analyzed in a distorted state. This capability is required to be able to define the required cavity shape at room temperature so that the distortion in the part will yield a dimensionally accurate part at room temperature.

Fundamentally, this research focuses on developing an understanding of the relationship between the die casting part and die through computer simulations. Understanding and prediction enables the development of die design techniques that help alleviate the problems that can arise due to the mechanical behavior of die casting dies and improve the dimensional quality of the part.

Depiction of Stresses in a Die Part



The techniques developed in this project will allow designers to compensate for the part and distortion during the die design stage.



Project Description

Goal: The goal of this project is to develop techniques for die casting part designers and die designers to consistently predict the shape of the part after cooling to room temperature. It also will develop the corresponding techniques to modify and improve the die geometry. This capability will allow designers to compensate for the part and distortion during the die design stage. It will ensure greater dimensional accuracy than is possible with current techniques.

Progress and Milestones

Prior research has shown that the magnitude of dimensional variations can be large and can vary by as much as a factor of four for the same part depending on the die design, the machine the die is run on, and the way the die is placed on the machine. This suggests that there is plenty of room left to optimize the designs and improve dimensional performance.

This R&D project's planned tasks are to:

- Develop a computational model accounting for pressure during fill and intensification and its effect on the part/die interface.
- Develop geometric software to calculate the best die cavity shape using distortion predictions as inputs.
- Confirm all results and methods with lab experiments.
- Determine the sensitivity of the results with respect to key features in the model.
- Evaluate the results and guidelines via in-plant field trials.



PROJECT PARTNERS

Ohio State University
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North American Die Casting Association
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Albany Chicago Co., Pleasant Prairie, WI
AMCAN, Ontario, CAN
Chicago White Metal, Bensenville, IL
DCD Technologies, Cleveland, OH
Exco Engineering, New Market, Ontario
Flow Science Inc., Los Alamos, NM
General Die Casters, Inc., Peninsula, OH
General Motors, Detroit, MI
JL French Corporation, Sheboygan, WI
Kirby, Andrews, TX
Metaldyne, Light Metals Division, Twinsburg OH
Magma Foundry Technologies, Inc., Arlington Heights, IL
Prince Machine, Holland, MI
Ryobi Die Casting (USA), Inc, Shelbyville, IN
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